REMARKS / ARGUMENTS

In the Office communication mailed April 13, 2004, the Examiner objected to the specification because of certain informalities; objected to claim 17 because of an informality; rejected claims 1-3, 10, 11, 13, 15-18, 20 and 22 under 35 U.S.C. § 103(a) as unpatentable over Roberts, U.S. Patent 3,747,679, in view of Machacek, U.S. Patent 4,115,165, and Alm et al., U.S. Patent 4,330,346; rejected claims 4-9, 19, and 24 under 35 U.S.C. § 103(a) as being unpatentable over Roberts in view of Machacek and Alms, and further in view of Anderson, U.S. Patent 6,405,627; rejected claims 1, 3, 10-12, 16, 18, 20 and 21 under 35 U.S.C. § 103(a) as being unpatentable over Mullay, U.S. Patent 4,097,316, in view of Machacek and Alm et al; and rejected claims 14 and 23 under 35 U.S.C. § 103(a) as being unpatentable over Roberts, U.S. Patent 3,747,679, in view of Machacek and Alm et al, and further in view of Mullay.

Claims 1, 16, and 17 have now been amended; claims 2 and 3 depend from amended claim 1; claim 18 depend from amended claim 16; and all other claims, namely claims 4-15 and 19-24, have now been canceled.

The Examiner is requested to reconsider and further examine this application, as amended, for the following reasons given in connection with a discussion of the prior art.

The Specification

The Examiner objected to the disclosure because, on page 13 of the original Specification, certain of the properties listed for aluminum flake appeared to be

inconsistent with the claims and with generally accepted units of surface area. Page 13 of the original Specification has now been amended to correct such informalities. More specifically, the characteristics given for aluminum power as --16 micron Surface Area, and 1.06 square meters per sq cm-- has now been amended to --16 micron particle size, and 1.06 square meters per cubic cm --. Such amendments are consistent with the original claims and do not, therefore, involve new matter.

Claim 17

Claim 17 was objected to because, in line 2, it was recited "o.5" and should be --0.5--. Claim 17 has now been amended to correct that informality.

Claim 1

Claim 1 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Roberts in view of Machacek and Alm et al; and additionally as being unpatentable over Mullay in view of Machacek and Alm et al. Claim 1 has been amended to more clearly define applicant's invention and more clearly distinguish applicant's invention from the prior art. More specifically, claim 1 has been amended to define applicant's invention as a **field mixable, binary, liquid** explosive **consisting** of a **non-explosive** solid component and **a non-cap sensitive** liquid component that can be combined and mixed together **in the field** to produce a **cap sensitive** explosive. The non-explosive solid component is defined as including aluminum powder containing stearic acid, while the non-cap sensitive liquid component is defined as including nitromethane. It is respectfully submitted that nothing in the prior art, taken singly or as a whole, discloses or suggests a field mixable, binary explosive as specifically defined by amended claim 1.

Both Roberts and Mullay teach directly away from a binary explosive **consisting** of a **non-explosive** solid component and a **non-cap sensitive** liquid component as defined by amended claim 1, to an explosive that comprises one or more **explosive and/or cap sensitive components**. Thus, in each of the examples disclosed in the Roberts patent, the explosive includes Nitroglycerine, RDX, Nitrocellulose, PETN, and/or HMX (see Examples I-V, column 6, line 61 through column 7, line 32 of the Roberts patent. Likewise, except for explosives prepared by employing a nitroparaffin emulsifier or by employing relatively high amounts of nitromethane and obtaining fine dispersion thereof by controlling mixing speed and temperatures (i.e., non-field mixable), the Mullay explosive require a booster system such as, for example, Pentalite, Composition B, RDX, or other similar primer in combination with a conventional blasting cap for detonation (see column 6, lines 23-39 of the Mullay patent).

Thus, even if it would have been obvious at the time the invention was made to have used the aluminum as taught by Machacek and Alms et al. with the composition of Roberts and/or Mullay, as proposed by the Examiner, such modified compositions would still lead one away from applicant's claimed explosive to an explosive comprising one or more **explosive and/or cap sensitive components**. Such a composition would be completely different from applicant's claimed explosive, could not be safely mixed in the field, and could not be used in the same manner or for the same purposes as applicant's explosive as defined by amended claim 1.

Accordingly, it is submitted that claim 1, as amended, is not suggested by the prior art within the meaning of 35 U.S.C. § 103. The Examiner is respectfully requested to reconsider and allow claim 1.

Claims 2 and 3

Claims 2 and 3 depend from amended claim 1 and distinguish from the prior art for the same reasons as hereinabove given relative to amended claim 1.

Accordingly, it is submitted that claims 2 and 3 are not suggested by the prior art within the meaning of 35 U.S.C. § 103. The Examiner is respectfully requested to reconsider and allow claims 2 and 3.

Claim 16

Claim 16 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Roberts in view of Machacek and Alm et al; and additionally as being unpatentable over Mullay in view of Machacek and Alm et al. Claim 16 has been amended to more clearly define applicant's invention and more clearly distinguish applicant's invention from the prior art. More specifically, claim 16 has been amended to define applicant's invention as method of making a **field mixable, binary** explosive **consisting** of the steps of providing a **non-explosive** solid component, providing **a non-cap sensitive** liquid component, and combining and mixing the **non-explosive** solid component and the **non-cap sensitive** liquid component together **in the field** to produce a **cap sensitive** explosive. The non-explosive solid component is defined as including aluminum powder containing stearic acid, while the non-cap sensitive liquid component is defined as including nitromethane. It is respectfully submitted that nothing in the prior art, taken singly or as a whole, discloses or suggests a method of making field mixable, binary explosive as specifically defined by amended claim 16.

As hereinabove discussed, both Roberts and Mullay teach directly away from a binary explosive **consisting** of a **non-explosive** solid component and a **non-cap sensitive** liquid component, to an explosive that comprises one or more **explosive and/or cap sensitive components**. Thus, in each of the examples disclosed in the Roberts patent, the explosive includes Nitroglycerine, RDX, Nitrocellulose, PETN, and/or HMX (see Examples I-V, column 6, line 61 through column 7, line 32 of the Roberts patent. Likewise, except for explosives prepared by employing a nitroparaffin emulsifier or by employing relatively high amounts of nitromethane and obtaining fine dispersion thereof by controlling mixing speed and temperatures (i.e., non-field mixable), the Mullay explosive require a booster system such as, for example, Pentalite, Composition B, RDX, or other similar primer in combination with a conventional blasting cap for detonation (see column 6, lines 23-39 of the Mullay patent).

Thus, even if it would have been obvious at the time the invention was made to have used the aluminum as taught by Machacek and Alms et al. with the composition of Roberts and/or Mullay, as proposed by the Examiner, such modified compositions would still lead one away from applicant's claimed method to an method in which one or more **explosive and/or cap sensitive components** are combined and mixed together. Such a method would be completely different from applicant's claimed method, could not be safely performed in the field, and would not produce an explosive having the same characteristic or that could be used in the same manner or for the same purposes as applicant's method as defined by amended claim 16.

Accordingly, it is submitted that claim 16, as amended, is not suggested by the prior art within the meaning of 35 U.S.C. § 103. The Examiner is respectfully requested

to reconsider and allow claim 16.

Claims 17 and 18

Claims 17 and 18 depend from amended claim 16 and distinguish from the prior art for the same reasons as hereinabove given relative to amended claim 16. Accordingly, it is submitted that claims 17 and 18 are not suggested by the prior art within the meaning of 35 U.S.C. § 103. The Examiner is respectfully requested to reconsider and allow claims 17 and 18.

Conclusion

The following background information will educate the reader as to some of the technical matters concerning Aluminum Powder, Nitromethane, binary explosives, blasting agents, etc. and define certain terms relating to the same:

Background Information Concerning Aluminum Powder

It is commonly known that aluminum is added to explosive compositions for two reasons: to <u>increase the sensitivity</u> of the product and <u>to increase the total energy</u> during detonation. However, there are many types of aluminum powders and granules.

It is commonly known that large particle aluminum and spherical aluminum powders will usually not do too much to increase the sensitivity of a composition, but will increase total energy of the explosion. These are used in mixtures where increased sensitivity is either not needed or not desired. For example they are used in blasting agents (for example, ANFO) to increase the energy. By definition, blasting agents are designed to be relatively insensitive, so more sensitivity is not desired. Also, the larger

particle aluminum powders are usually less expensive and easier to handle than the aluminum described in the next paragraph.

It is commonly known that flake aluminum of small particle size with a large surface area relative to its volume is usually the best sensitizer for explosive compositions, where sensitization is desired. There is some difference in opinion as to how this sensitization occurs. One theory is that the particles form "hot spots" or reaction zones on the surface of the aluminum when they are struck by the detonation wave. Spherical aluminum powders have smaller surface areas than the flake aluminum for a given particle size. Therefore the spherical aluminum powders do not sensitize as well as the flake type.

It is commonly known that flake aluminum is very dangerous when uncoated. It tends to "float" in the air, thereby causing an explosion hazard. A spark can initiate a "dust explosion" from the reaction of the floating aluminum dust and the oxygen in the air.

Therefore, it is common practice to coat the flake aluminum powder with Stearic Acid and other additives so that it does not float in the air. This is commonly known as "dedusted" powder. Because this type of aluminum powder is commonly used for making silver colored paint, it is known as "paint grade" aluminum. Although the Stearic Acid and other additives (Teflon, Stoddard Solvent, etc.) may in someway act as thickeners when mixed with solvents (mineral oil, paint thinner or here, Nitromethane), the primary reason for their inclusion is ease and safety in handling during manufacturing processes.

The U.S. Department of Transportation (DOT) and International Hazard

Classification of this type of aluminum is normally "Flammable Solid". We will discuss the significance of this later.

Background Information Concerning Nitromethane

Nitromethane is an interesting substance. In its pure form, it is a colorless liquid with a slight, but distinctive fruity odor. It is classified as a "Flammable Liquid" by the US Department of Transportation. One of its major uses is as a fuel component in drag racing. It is normally purchased in standard 55 gallon drums weighing 500 pounds per drum. It is very expensive, costing between $800.00 to $1000.00 per drum.

Nitromethane's uses as an explosive and a component of explosive products are less well known and even less understood. This is to include those familiar with and skilled in the art of explosives manufacturing and formulary. As mentioned in the present patent application, its use as one component of the binary explosive product "Kinepak" is common knowledge for those in the explosive business. It has been commercially available for about 30 years and is based on Hurst, U.S. Patent 3,718,512. In the Kinepak system, the other component is finely divided (powdered) Ammonium Nitrate. As a binary explosive, it is mixed in the field by pouring the Nitromethane into the container of Ammonium Nitrate. After the Nitromethane has completely permeated the Ammonium Nitrate powder it is a "cap sensitive" high explosive. This simply means that it will detonate unconfined with a standard #8 strength blasting cap. The cartridges vary in size, but the smallest one produced is about 1-3/8" in diameter and 8" long. This cartridge is about the same size as the smallest stick of dynamite commercially available. The characteristics of this product are approximately the same as nitroglycerine dynamite, so it can be used instead of dynamite in most applications. The advantages of

using a "two-component" product instead of a "ready-to-go" explosive are several. The most important of which are: little if any restriction on transportation and no special requirements for storage. The disadvantages are the increased cost of the product, as well as the work and time involved in mixing the product.

In the Kinepak system, the resulting explosion is a typical Fuel (nitromethane) and Oxidizer (ammonium nitrate) reaction. Most watergels, emulsions and blasting agents are based upon this type of reaction. For example, one of the most utilized explosives in the industry is Ammonium Nitrate / Fuel Oil, commonly known as ANFO. Here, the Ammonium Nitrate is in the form of Prills (little BB sized balls) and the Fuel Oil is most commonly #2 Diesel fuel. The correct mixture is 6 percent Fuel Oil, by weight, with the balance being the prilled Ammonium Nitrate. Although from a practical standpoint, this has been found to be the best mixture, just about any hydrocarbon fuel (waste oil, gasoline, wax, paint thinner, etc.) will work when thoroughly mixed with the Ammonium Nitrate.

The question at this point may be why does Kinepak exist when ANFO is much cheaper per unit weight? (the fuel oil costs pennies compared to Nitromethane) The answer is simple. ANFO is a blasting agent. Blasting agents are by design and definition not <u>cap</u> sensitive. A blasting cap, by itself, will not initiate Blasting Agents when unconfined. Blasting agents require another high explosive, called a booster, in order to explode. Also, Blasting Agents will not work in small diameter cartridges. They are normally poured into holes in the ground of at least 3 to 4 inches in diameter. For example, if you put ANFO in a plastic pipe, say, one inch in diameter, the explosion (the detonation wave) would not travel very far in the pipe, even if you properly initiated

one end of the pipe. This is because the one inch pipe is below the "critical diameter" of the ANFO. The critical diameter of an explosive (usually qualified as confined or unconfined) is defined as the smallest diameter that will allow a detonation wave (the explosion) to continue without stopping. The critical diameter for ANFO is about 3 inches, depending on confinement. In general more confinement (for example a steel pipe instead of plastic) will decrease the critical diameter for a given explosive material.

Whether or not a standard blasting cap will detonate a given explosive material and the material's critical diameter are good indications of it's relative sensitivity when compared with other explosives. For example, the critical diameter for Kinepak and dynamite is significantly less than the smallest cartridges in which they are produced.

But let's go back to the Kinepak two-component product. Since Nitromethane is so expensive, why not just put some other liquid in the powdered Ammonium Nitrate instead? Maybe something like paint thinner, gasoline, oil, etc. Because it won't work. You would be basically making something like ANFO, but it won't work in small diameters and it won't be cap sensitive. You may find that the mixture would be more sensitive than the mixture using Prills, but this is to be expected because of the small particle diameter of Kinepak's Ammonium Nitrate powder.

So what makes Nitromethane work with the powdered Ammonium Nitrate, while other things won't? The reason is that <u>Nitromethane is an explosive</u> in its pure state. However, according to the tests and definitions of both the U.S. and international regulatory agencies, it is classified as a Flammable Liquid for transportation. The primary reason is that Nitromethane is so insensitive to initiation, there is little if any possibility of it exploding under normal and abnormal transportation events. In the case of the

Kinepak, it seems as though there is a "symbiotic" relationship between the two components. It will be explained how later, but the theory is that the Ammonium Nitrate "sensitizes" the Nitromethane so that it is cap sensitive, then the Nitromethane acts as a fuel for the Ammonium Nitrate.

Neat (pure) Nitromethane will detonate when heavily confined at elevated temperature and/or pressures. It will also detonate when heavily confined and subjected to a shock from another explosive or impact.

By definition, High Explosives "detonate" and Low Explosives "deflagrate" (burn rapidly). In a true detonation, a "detonation wave" travels though the material at super sonic velocity (called the "velocity of detonation" or VOD). At this wave front, the material, originally in the form of a solid or liquid, is instantly transformed into a high pressure, high temperature, high velocity gas.

On the other hand, a deflagration is a high speed burning reaction that generally occurs on the surface of the material and works its way to the center. In order for the material to be called an "explosive", it must contain within itself all the ingredients required to react. Normally, this requires a Fuel and an Oxidizer. The best example of this is Black Powder. The ingredients for Black Powder are Potassium Nitrate (the Oxidizer), Sulfur and Charcoal (both Fuels). In order to make Black Powder, these three ingredients are first mixed in the proper proportions. They are finely ground, wetted and then dried in cakes or sheets. These cakes are then further ground and sifted to obtain the proper size granules for the intended use.

One use of Black Powder is as a propellant for muzzle loading firearms and cannons. In simple terms, a measure of Black Powder is confined behind a projectile in

the barrel of the weapon. When a spark is applied, the Black Powder burns very rapidly (deflagrates) and pushes the projectile from the barrel. Although there is a very load noise as a result of the rapidly expanding gases as the projectile clears the muzzle of the barrel, there was no detonation. Had there been a detonation, the barrel would have been destroyed as a result. A detonation produces pressures many times that of a deflagration. Although some materials can and will transition from a deflagration to a detonation, Black Powder will not.

Then why are gasoline, diesel fuel, kerosene, and the like not called explosives? The answer is that they require Oxygen from the atmosphere (or from another source) to burn. Take a closed iron pipe filled with Gasoline, then put it in a fire and see what happens. The container will build up pressure from the boiling gasoline and eventually burst the pipe. The Gasoline vapors will ignite and burn. If there is an "explosion" sound, it will be from the mechanical bursting of the pipe, not unlike the popping of a balloon. The recovered pipe will most likely just have a split down one side.

Nitromethane, in a similar situation as described above, will behave in a totally different manner. Previously, we learned that Nitromethane will detonate at elevated temperatures and pressures. This is exactly what a closed pipe filled with Nitromethane will do when subjected to a fire. There will be an extremely loud noise as the Nitromethane detonates in the pipe. The shock wave accompanying the detonation of the Nitromethane will shatter the iron pipe into many small pieces, producing high velocity shrapnel.

For the purposes of this discussion, we need to divide the High Explosives (the ones that Detonate) into two subcategories: molecular explosives, and (for lack of a

better term) non-molecular explosives. Molecular explosives are ones which are made up of individual molecules of the explosive. Examples of common molecular explosives are:

Cyclotetramethylene Tetranitramine (HMX): $C_4H_8N_8O_8$

Cyclotrimethylene Trinitramine (RDX): $C_3H_6N_6O_6$

Pentaerythritol Tetranitrate (PETN): $C_5H_8N_4O_{12}$

Trinitrotoluene (TNT): $C_7H_5N_3O_6$

Nitroglycerine: $C_3H_5N_3O_9$

Nitromethane: CH_3NO_2

Non-molecular high explosives are products such as:

Water-Gels: combinations of Ammonium Nitrate, other Oxidizers, Fuels and/or Aluminum Powder

Emulsions: combinations of Ammonium Nitrate, other Oxidizers, Fuels and/or Aluminum Powder

ANFO: Ammonium Nitrate and Fuel Oil (#2 Diesel) (some are aluminized).

Molecular explosives usually have a higher velocity and greater density than the non-molecular types. Although there are other factors, these two characteristics will generally give a good indication as to the "power" of the explosive. In simple terms, the molecular explosives can be packed tighter per unit volume (greater density) and the reaction can take place faster because it is taking place on a molecular level.

Non-molecular explosives, such as ANFO, have a relatively slow velocity when compared with most other explosives. For the intended applications, this is not

necessarily a bad thing. In general, the slower velocity explosives tend to heave and push, whereas the higher velocity explosives tend to have a shattering effect. The heaving and pushing is preferred when you are trying to move material such as rock. Other non-molecular explosives such as Water-Gels and Emulsions achieve higher velocities than ANFO by having components with very small particle size in intimate contact with each other. How this is achieved is the subject of many patents.

Now, back to the molecular explosives. HMX, PETN, RDX, TNT and Nitroglycerine are all "ready to go" High Explosives. They are all Classified in the United States and Internationally for transportation purposes as Class 1.1D Explosives. HMX, PETN and RDX are so sensitive, that they must be shipped wet (with water or alcohol). Nitroglycerine is not allowed to be shipped in its pure form. It must be desensitized by some means before being transported.

The following is why Nitromethane is such an interesting material:

Nitromethane is a molecular explosive.

Because of it's low sensitivity, it is not considered or regulated as an explosive for transportation purposes.

It can be used as a fuel (drag racing).

It can be used as a fuel in other explosive mixtures (e.g., with ammonium nitrate).

It can be sensitized by several means so that it is a cap sensitive explosive.

When sensitized, it can be a Liquid Explosive. There are few, if any liquid explosives available in any form.

How to Sensitize Nitromethane

There are three ways to sensitize Nitromethane so that it is cap sensitive.

1. Air Entrapment: Air can be entrapped in Nitromethane liquid by several means. The most common way is by using micro-balloons. These balloons can be made of glass, plastic or some other resin material. Since these balloons tend to float to the surface of the Nitromethane, a thickener is usually employed to keep them disbursed throughout the mixture.

The same balloons are used in Water Gels and Emulsions for the sensitization of these products. It is known that Kinepak contains a percentage of micro-balloons in the Ammonium Nitrate.

Another means to trap air in the Nitromethane is to combine it with some porous material containing air such as foam, sawdust, perlite (expanded silica), clay, etc. Although we know first hand that these will form detonable mixtures, it does not mean that a marketable product can be made from them.

The theory of the air entrapment is that the balloons form "hot spots" when impacted by the detonation wave, due to adiabatic compression of the air bubble.

The disadvantages of this method:

decreased density, therefore decreased velocity and power;

the air entrapment means are inert, therefore they do not contribute to the explosion, therefore less power;

difficult to maintain a homogeneous mixture;

depending on the means of air entrapment, initiation sensitivity can be inconsistent; and

large critical diameter.

2. Adding Amines: Adding certain Amines to Nitromethane is a well known

means of sensitization. Specifically, a mixture of Nitromethane with 5% ethylene diamine is known as PLX (Picatinny Liquid Explosive). It was used at one time to simulate underground nuclear explosions. However, this mixture, because of reasons listed below, is not a commercially viable product.

The disadvantages of this method:

ethylene diamine is a caustic and hazardous material to work with;

the mixture is marginally cap sensitive; and

the mixture is not stable over a period of time.

3. Adding Paint Grade Aluminum: Unlike the previous two, this method was not known prior to the present invention, and is the basis for the present patent application.

When the examiner rejected the claims of the present patent application, the following patents were cited:

Roberts, U.S. Patent 3,747,679, Method of Fracturing a Formation Using a Liquid Explosive.

<u>Summary:</u> This patent deals with the manufacture of a new liquid explosive for fracturing a geological formation, specifically related to oil or gas production in wells. As described here, the new liquid explosive is pumped down the well and into the crack and fissures at the bottom. When detonated, the oil or gas should (theoretically) flow more freely to the surface.

The explosive described by Roberts is composed of the following in various combinations:

a nitroparaffin, the preferred being Nitromethane (Col 4, line 55)

a nitramine explosive, such as RDX and/or HMX (Col 5, lines 10 to 20)

"Detonation Aids", such as Nitroglycerine and/or PETN (Col 5, lines 25 to 40)

"Ballistic Modifier", such as metallic powder (Col 4, line 20), magnesium, aluminum, etc. of the size 8 to 12 micron being preferred (Col 5, lines 40 to 50)

Gelling or thickening agent, such as nitrocellulose (also an explosive) or other types of cellulose (Col 5, lines 55 to 65)

Other processing aids such as wetting agents, thixotropic agents and stabilizers. (Col 6, lines 0 to 10).

Comments:

1. At the bottom of page 2 of the *Detailed Action*, the examiner rejects certain claims as being unpatentable by referencing "Example 1" (Col 6, line 60 to 65): "Roberts discloses a composition that comprises 66% nitromethane, 12% of aluminum powder of size less than 15 microns, and 1% Cab-O-Sil (amorphous fumed silica)" This is misleading because he failed to mention that the composition listed in "Example 1" also includes Nitroglycerine (10%), RDX (9%), Nitrocellulose (1%) and Chalk (1%). Without these additional explosive components, the mixture would not have worked as intended.

2. The present invention consists of a mixture of two components: a non-cap sensitive liquid component including Nitromethane, and a non-explosive solid component including aluminum powder containing stearic acid. The mixture may be 13 to 20% paint grade aluminum powder of a particle size of 5 to 50 microns and a surface area of .5 to 2 square meters per cubic centimeter, containing (as a coating) .1 to 5% stearic acid by weight.

3. Further, the present invention is a field mixable product containing two

components (binary), neither of which are considered to be explosives by the regulating agencies of the United States Government. Roberts' mixture is not field mixable. Because of the hazardous (explosive) nature of the components, his mixture would have to be blended under very controlled conditions. Roberts' mixture is not binary, but contains many components, of which most are molecular explosives (HMX, PETN, RDX, Nitrocellulose, Nitroglycerine). Considering these other ingredients, Roberts' mixture would likely have still been explosive even if something inert had been substituted for the nitromethane or the aluminum.

4. To make a comparison, let's say that we are trying to make a sweet drink. In the case of the present invention, it is like vinegar and a special salt were combined to make a new sweet soft drink. The mixture described in Roberts' patent is like taking the same vinegar and regular salt, then adding corn syrup, molasses, sugar and honey then being surprised that the result is sweet.

5. In the middle of the first paragraph on page 3 of the *Detailed Action*, the examiner states: "The surface area is an inherent property of the aluminum that is disclosed." This is not true. In Roberts' patent, he does not discuss the surface area of the metallic powders, to include aluminum, only the particle size. There are many different types of aluminum powders. Roberts does not specify the type of aluminum powder, only the particle size. Different aluminum powders of the same particle size can have surface areas that vary greatly. (see patent #4,115,165 by Machacek, Col 1, lines 55 to 60 and Col 3, lines 40 to 45). Therefore, the surface area is not an inherent property of the aluminum powder disclosed in Roberts' patent.

Machacek, U.S. Patent 4,115,165. Hydrophobic Aluminum Sensitizing Agents

for Explosives.

Summary: This patent deals with the manufacture of water gel explosive compositions containing aluminum particles coated with hydrophobic fumed silica. The theory is that the silica coated aluminum particles cause an air bubble to be formed (entrapped) next to the aluminum. This air bubble increases the sensitivity of the mixture, as previously discussed in the background information. In the text of the patent, he goes into detail explaining the difference in the various types of aluminum powders and the effects on sensitization (or lack of) for aqueous (water) gel explosives.

The main point of this patent is that the sensitizing effect of the paint grade aluminum is well known. However, the paint grade aluminum is expensive. By coating the cheaper spherical grade aluminum with fumed silica, the same sensitization effect can be achieved at a lower cost in water gel explosives.

Comments:

1. In the second paragraph of page 3 of the *Detailed Action*, the examiner states: "Machacek teaches that it is known to coat aluminum with stearic acid to impart a sensitizing effect in water gel explosives...." As stated before, this is well known. This was stated this in the present patent application, page 7, line 22, referencing Machacek.

2. The Machacek patent deals with sensitizing and manufacturing water gel explosives. There are many, possibly hundreds, of patents dealing with this subject. Again, the present invention deals with ***a two component, field mixable explosive***. Take a look at any of the examples listed in this patent. They contain numerous components: Ammonium Nitrate, Sodium Perchlorate, Water, Ethylene Glycol, Guar Gum, Atomized Aluminum, Silica, etc. Then, they must be mixed in bulk under exacting

conditions. This is not even closely related to the present invention.

Alm et al., U.S. Patent 4,330,346, Cap-Sensitive Powdered Explosive Composition.

Summary: This patent deals with the manufacture of gel type explosive compositions containing aluminum. Although not exactly a "water" gel, the product discussed here contains other liquids and is very similar to other water gel type mixtures.

Comments:

1. As previously mentioned, this is one of many patents related to this type of explosive.

2. Again, the sensitizing effects of paint grade aluminum are well known. It is also known that paint grade aluminum powders contain stearic acid and is again stated in this patent.

3. Again, the present invention deals with ***a two component, field mixable explosive***. Take a look at any of the examples listed in the Alms et al. patent. They contain numerous components: Ammonium Nitrate, Ethylene Glycol, Propylene Glycol, Glycol Methyl Ether, Guar Gum, Aluminum Powder, Silica, etc. Then, they must be mixed in bulk under exacting conditions. This not even closely related to the present invention.

Anderson, U.S. Patent 6,405,627, Simple Kit and Method for Humanitarian Demining... etc.

Summary: This patent describes an explosive mixture of nitroparaffins (to include Nitromethane) and a means to sensitize the same. Also described is a method for mixing and containing the product.

Comments:

1. This patent comes closer to the present invention than any other. It is a field mixable two part explosive.

2. Half of the patent pertains to the containers. Everything they show in this patent relating to containers is common knowledge, not only for everyday items, but for explosives too. The idea of binary explosives is not new. The idea of using explosives (binary or not) for ordnance and mine disposal has been known ever since they invented ordnance and mines.

3. The sensitization method used in this patent is air entrapment, either by foam, microspheres, etc. All well known.

4. Anderson mentions "aluminum" in this patent two times, both in the same context and only once in a claim. The last line of Claim 12 states: ".... said sensitizing means is selected from the group consisting of microspheres and finely divided aluminum powder." This and all of the other claims include thickeners (fumed silica) and air entrapment sensitizers such as microspheres, foams and/or sponges, with no mention of aluminum (other than Claim 12)

5. Anderson does not describe the size or type of aluminum in Claim 12.

6. Anderson does not mention a mixture of only Aluminum Powder and Nitromethane in this patent.

7. A product based on this patent is being manufactured and marketed by a company called MREL. The product's name is FIXOR. As mentioned before concerning the air entrapment method of nitroparaffin sensitization, there are several disadvantages to their system:

decreased density, therefore decreased velocity and power;

the air entrapment means are inert, therefore they do not contribute to the explosion, therefore less power;

difficult to maintain a homogeneous mixture;

depending on the means of air entrapment, initiation sensitivity can be inconsistent; and

large critical diameter.

8. The present mixture, the Paint Grade Aluminum Powder and Nitromethane, exhibits none of the disadvantages in #7 above.

Mullay, U.S. Patent 4,097,316, Method for Gelling Nitroparaffins in Explosive Compositions.

Summary: This patent deals with a method of gelling nitroparaffins in explosive compositions. This gel is then to be added to, what appear to be, conventional water gel explosive mixtures.

Comments:

1. In this patent, the gelled nitroparaffin is combined with standard water gel materials which may include aluminum.

2. Nothing is said about any specific aluminum, and it is mentioned in only two of the 49 Claims (Claims 6 and 47)

3. In both claims, the aluminum is listed as a "Fuel", not a sensitizer. Since this patent was issued in 1978, the sensitizing properties of certain aluminum powders may not have been well known at that time.

4. Again, this is not a binary, field mixable product.

Summary:

The present invention is a FIELD MIXABLE, TWO COMPONENT HIGH EXPLOSIVE, where the only two components are a non-explosive solid component including aluminum powder containing stearic acid, and a non-cap sensitive liquid component including Nitromethane.

It is known that Nitromethane is a very insensitive molecular explosive.

It is known that Nitromethane can be made to be more sensitive by the addition of certain amines and other chemicals.

It is known that Nitromethane can be made to be more sensitive by the addition of air entrapping means.

It is known that most Aluminum Powders can be used to increase the energy of most explosive compositions.

It is known that Aluminum Powders known as "Paint Grade" will increase the sensitivity of explosive compositions known as water gels, blasting agents and emulsions.

The present invention, a cap sensitive liquid explosive, was invented by combining Nitromethane with Paint Grade Aluminum Powder.

There is no disclosure or suggestion in the literature of combining Nitromethane with Paint Grade Aluminum Powder to form a cap sensitive liquid explosive.

The present invention can do things that no other commercially available explosive can do (binary or otherwise). For example there is no other explosive available that can be poured into a shaped charge and can be used for a useful purpose.

During the last year, over 10,000 pounds of this material has been sold to users in

Industry, Law Enforcement and the Military.

In conclusion, it is submitted that the present application and all of its remaining claims are now in condition for an early allowance. All the prior art of record has been reviewed and considered but are not felt to come within the coverage of the claims now in this case or to disclose or suggest the invention as specifically defined by the claims now in this case. Nothing in the prior art, taken solely or combined, discloses or suggest a field mixable, binary, liquid explosive consisting of a non-explosive solid component including aluminum powder containing stearic acid, and a non-cap sensitive liquid component including nitromethane, or a method of mixing those two components to make a field mixable, binary, liquid explosive. If the Examiner is of the opinion that a telephone conference relative to this case would advance the prosecution, the Examiner is respectfully requested to call the undersigned attorney at the indicated telephone number.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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Date: 10-12-04

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